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The Effect of mAs Variation on Noise in Phantom Pelvis Using a Computer Radiography (CR)

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ABSTRACT

The quality of radiographic images is the accuracy of the patient's anatomical representation on the radiographic image. To produce high-quality images, the most important characteristics of radiographic image quality are spatial resolution, contrast resolution, noise, and artifacts. An increase in tube current causes a decrease in noise value. In radiographic imaging, noise is influenced by several factors including the strength of the tube current. Basically the tube current chosen is at the highest mAs that the aircraft can achieve, so that the exposure time can be as short as possible, so as to prevent image blurring caused by movement. This study aims to analyze the influence of mAs varieties on noise on radiographic images. This research was carried out using an experimental study method at Siti Rahma Padang Hospital, on May 27, 2024. Using the phantom pelvis of Baiturrahmah University Padang to obtain the results of the description of five different variations of mAs: mAs 8, mAs 10, mAs 12, mAs 14, mAs 16, with a tube voltage of 70. The data was processed using SPSS using the ANOVA One Way test, in the form of a table. Producing a calculated F value of 4.673 which shows a significant relationship between the strength of the tube current and noise with ap value of 0.002 (< 0.05). This study concluded that there was a significant influence between the results of mAs variation on noise.

Keywords: mAs Variation, Noise, Influence, Image Quality, Exposure Factor

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1. Introduction

Radiology plays a crucial role in supporting examinations or establishing a diagnosis of a disease. These examinations or diagnoses are performed using X-rays, resulting in radiographic images (Labania et al., 2021). Radiographic examinations of the body's anatomy can provide the maximum possible information, making it easy for radiologists to determine the correct diagnosis. High-quality radiographic images are essential for accurate diagnosis in the field of radiodiagnostics (Dhahryan and Azam, 2009).

Radiographic image quality refers to the accuracy of the representation of a patient's anatomy on a radiographic image. High-quality images are essential for radiologists to make accurate diagnoses. To produce high-quality images,

radiographers apply knowledge of three main, interrelated categories of radiographic quality: film factors, geometric factors, and subject factors. Each of these factors influences radiographic image quality and is under the control of the radiologic technologist. The most important characteristics of radiographic image quality are spatial resolution, contrast resolution, noise, and artifacts (Bushong, 2013).

The increase in the tube current will be followed by the large number of electrons produced and affect the number of X-ray photons produced. The magnitude of this current determines the quantity of radiation. If the exposure factor is increased, it will produce more signals that affect the detector which will reduce noise in the radiograph image. When the mAs value increases, the higher the mAs value, the more X-ray photons are produced and the resulting penetration power is greater so that the beam of light captured by the detector will increase which will affect the received signal higher than the scattered radiation that causes noise. High tube current is usually used for examining bone structures such as the pelvis and vertebrae. On the other hand, a larger tube current value will produce better images and reduce noise that can be seen in the form of spots in the image (S. Riyanto, WS Budi & C. Anam, 2019).

Based on experience during fieldwork practice in a hospital, many officers or radiographers still pay less attention to the exposure factor, namely mAs, when carrying out examination procedures. Therefore, the researcher wanted to know the results of the effect of mAs variations on noise by using variations of mAs 8, mAs 10, mAs 12, mAs 14, mAs 16, which produce less noise so that the optimal use of mAs variations in pelvic examinations can be achieved

2. Method

The type of research used is Quantitative using the experimental study method at RSI Siti Rahma Padang, on May 27, 2024. Sampling used the total sampling technique so that samples were obtained from the results of pelvic radiographs.The tools used in this study were x-ray machines, CR cassettes, pelvic phantoms, and computed radiography (CR). Then, the study was conducted with varying mAs, namely: mAs 8, mAs 10, mAs 12, mAs 14, mAs 16, with Kv 70. After obtaining the results, questionnaires were distributed to 18 radiographers as respondents. After obtaining the results from the respondents, the data were processed using SPSS with the One Way ANOVA test and the results were presented in tabular form

3. Result And Discussion

Result

1. Sample 1 mAs 8 examinations were conducted on May 27, 2024

2. Sample 2 mAs 10 examinations were conducted on May 27, 2024

3. Sample 3 mAs 12 examinations were conducted on May 27, 2024

4. Sample 4 mAs 14 examinations were conducted on May 27, 2024

5. Sample 5 mAs 16 examinations were conducted on May 27, 2024

From the five samples, it can be seen that the image results for mAs 8 show very high black and white spots which can interfere with the radiographic image results, for the image results for mAs 10 the black and white spots appear to be less good which can interfere with the radiographic image results, for the image results for mAs 12 the black and white spots appear to be good which can interfere with the radiographic results, for the image results for mAs 14There is a very low black and white spot image that can interfere with the radiograph results, for the mAs 16 image results there is no black and white spot image that can interfere with the radiograph results.

Table 4.6 Average mAs Variation Against Noise

Tabel 4.6 Rerata Variasi mAs Terhadap Noise

Variasi mAs	N	Mean	Std. Deviation	Std. Error	Minimum	Maximum
8 mAS	18	10.06	2.645	.623	6	14
10 mAs	18	10.11	2.423	.571	5	14
12 mAs	18	10.83	2.455	.579	6	15
14 mAS	18	11.56	2.175	.513	7	15
16 mAS	18	12.94	2.014	.475	9	16
Total	90	11.10	2.540	.268	5	16

Table 4.11 ANOVA

	df	F	Sig.
Between Groups	4		
Within Groups	85	4,673	.002
Total	89		

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Based on the results obtained, the p value is 0.002 (<0.05) and the calculated f is 4.673. The higher the calculated F value obtained, the more influence there is on the two independent and dependent variables. The smaller the significant value obtained, the more influence there is between the variables. Therefore, Ho is rejected and Ha is accepted. This means that there is a significant influence between the results of the mAs variation on noise. From the results obtained, each increase in mAs results in less noise being produced.

Based on the results of the research that has been done, the researcher wants to see how the use of mAs variations affects noise in pelvic radiograph images and based on the results of the questionnaire obtained from 18 radiographer respondents by getting the results of 4 questionnaire questions, the first question is how radiograph noise is used in pelvic examinations, how are the boundaries between adjacent objects in the pelvis, how are the differences between objects and anatomical structures in the pelvis, how much influence mAs has on noise in pelvic image results. Based on the results obtained, the p value is 0.002 (<0.05) and the calculated f is 4.673, the higher the calculated F value obtained, the more influence there is on the two independent and dependent variables, the smaller the significant value obtained, the more influence there is between variables, then Ho is rejected and Ha is accepted, meaning there is a significant influence between the results of mAs variations on noise, from the results obtained, each increase in mAs results in less noise produced. Based on this research, the influence of mAs variation on noise has been studied, and the

highest mean value is obtained at mAs 16, which is 12.94, so it can be said that the mAs variation of 16 is very good.

Based on the discussion of the average value above, it can be seen that the provision of exposure factors, especially mAs, can affect the increase in noise in radiographic images using CR because the higher the mAs used, the less noise is produced (Searam, 2019).

Discussion

Based on the results of the research that has been done, the researcher wants to see how much optimal use of mAs variations in pelvic examinations will be seen from the highest value of each question on mAs 8, for mAs 8 on question 1 for those who answered not well amounted to 10 people with a percentage (55.6%). For question 2 for those who answered well amounted to 7 people with a percentage (38.9%). For question 3 who answered well amounted to 5 people with a percentage (27.8%). For question 4 who answered very well amounted to 12 people with a percentage (66.7%). From each question on mAs 8, the overall mean result was (10.06). For mAs 10 on question 1 who answered not well amounted to 9 people with a percentage (50.0%). For question 2 who answered well amounted to 9 people with a percentage (50.0%). For question 3 who answered well amounted to 6 people with a percentage (33.3%). For question 4 who answered very well amounted to 13 people with a percentage (72.2%). From each question in mAs 10, the overall mean result was (10.11). For mAs 12, in question 1, 10 people answered that it was not good with a percentage of (55.6%). For question 2, 9 people answered that it was good with a percentage of (50.0%). For question 3, 6 people answered that it was very good with a percentage of (33.3%). For question 4, 13 people answered that it was very good with a percentage of (72.2%). From each question in mAs 12, the overall mean value was (10.83). For mAs 14, in question 1, 7 people answered that it was not good with a percentage of (38.9%). For question 2, 9 people answered that it was good with a percentage of (50.0%). For question 3, 8 people answered that it was good with a percentage of (44.4%). For question 4, 14 people answered that it was very good with a percentage of (77.8%). From each question in mAs 14, the overall mean value was (11.56). For mAs 16, on question 1, 11 people answered quite well with a percentage of (61.1%). For question 2, 10 people answered very well with a percentage of (55.6%). For question 3, 9 people answered very well with a percentage of (50.0%). For question 4, 14 people answered very well with a percentage of (77.8%). From each question on mAs 14, the overall mean value was (12.94).

Based on this research, the influence of mAs variation on noise has been studied, and the highest mean value is obtained at mAs 16, which is 12.94, so it can be said that the mAs variation of 16 is very good.

CONCLUSION

The higher the mAs value used in the pelvic examination, the less noise is produced on the pelvic radiograph. The results of the analysis show that the null hypothesis (Ho) is rejected and the alternative hypothesis (Ha) is accepted, which means there is a significant effect between mAs variations on noise with a contribution of 16.4%. Based on the results of data processing using SPSS

through the ANOVA test, it is known that at a mAs variation of 16, the average image value is 12.94, which indicates that the noise level has decreased. Thus, increasing the mAs value has an effect on improving the quality of pelvic radiograph images by reducing noise.

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